

Based on practice within your school setting evaluate how current initiatives support the development of numeracy across the curriculum for a specific age group.

This assignment will evaluate how current initiatives can support the development of numeracy across the curriculum. It will draw on examples used within a primary school setting of approximately 500 pupils aged 3 to 11 years old, which we shall refer to as Setting A. Setting A identifies around 11% of its pupils as having additional learning needs (ALN), which is lower than the national average of 22%, and fewer than 20 pupils have a statement of special educational needs. We will look briefly at the historical setting of maths in education, before moving on to look at the current initiatives used to support numeracy, and how these initiatives develop numeracy across the curriculum. This assignment will outline the key ideas in the Literacy and Numeracy Framework (LNF), focusing specifically on the cross-curricular method of teaching numeracy and its benefits. It will also consider how pupils are monitored and assessed, and how this can then be utilised to improve pupil performance, and enhance the learning experience. This assignment will give examples of how this is being put into practice within Setting A, and also look to the future by considering possible ways forward.

As far back as 1978, the Government commissioned an inquiry into whether the current education system was providing learners with the transferable skills needed to be fully contributing members of society. The resulting Cockcroft Report (1982, p.4) recommended that teachers should enable pupils to 'develop the mathematical skills and understanding required for adult life, for employment and for further study and training'. The report discovered a disparity between what children were doing in school, and the skills that working establishments required from those who left school for employment, and recommended that the teaching of maths should not just be about the principles, but also about the practical applications for everyday day life i.e. numeracy. Crockcroft (1982) stated that:

we would include among the mathematical needs of adult life the ability to read numbers and to count, to tell the time, to pay for purchases and to give change,

to weigh and measure, to understand straightforward timetables and simple graphs and charts....those who teach mathematics in schools should do all that is possible to enable their pupils to include as part of their mathematical knowledge those abilities (Cockcroft, 1982, p.10).

However, the Education Reform Act (1988), arguably the most important piece of education legislation since the Education Act (1944), did not embrace these recommendations wholeheartedly. The National Curriculum was introduced, but written by non-teaching staff. Teachers then became deliverers of a curriculum rather than innovators or facilitators. The 3 core subjects of Maths, English and Science were to be taught separately, with an additional 6 foundation subjects to be covered. This segregation of disciplines made integrated cross-curricular topic work very difficult, and numeracy across the curriculum was not definitively encouraged. Maths was taught rather than explained or applied to real life situations. Key Stages were introduced, and a programme of study for each of these was developed with SATs testing being the measure of attainment of these targets at the end of each Key Stage. The basis of the national curriculum was to standardise what was being taught across all schools in order to improve attainment levels. But there was widespread protest by both parents and teachers who thought the system was flawed, and that testing created stress amongst pupils, especially amongst those who were not able to recall facts and figures for the snapshot moment of the tests.

As a result, the Welsh Assembly Government developed the Skills Framework for 3-19 year olds in Wales (2008) to try and enhance life-skills, but being non-statutory it was not as successful as hoped. In 2010 the Programme for International Student Assessment (PISA) tests were published. These tests are taken by 15 year olds across the world, and the outcomes for Wales in comparison with other countries were not good. As a consequence of such poor performance, the Welsh Government introduced the statutory Literacy and Numeracy Framework (2013) (LNF) which was designed to help teachers embed literacy and numeracy into all subjects for learners aged 5 to 14 (Learning Wales, 2016). The framework runs alongside the National Curriculum, but provides a specific list of competencies or skills for each year group.

The aim of the framework is to ensure that schools are working more consistently across Wales to incorporate both literacy and numeracy across the curriculum, and impart practical life-skills to learners. There are 2 frameworks that run in parallel, one for literacy and another for numeracy, both of which are statutory requirements in Wales from Reception through to Year 9. This assignment will focus purely on the numeracy part of the framework. The framework is broken down into Phases (e.g. KS1, KS2) and then further into year groups. For each Phase/year group 4 main Strands are identified:

- developing numerical reasoning
- using number skills
- using measuring skills
- using data skills

(LNF, 2013)

It is no co-incidence that these strands use the words 'develop' and 'using' in their titles. The framework is important because it requires the use of number, the transfer of skills to everyday situations, and aims to develop the links between maths knowledge and the relevant skills. 'Numeracy is different to the mathematics subject in that it is the application of the skills learned in mathematics in a cross-curricular, real-world way, and not purely about the skills themselves' (LNF:Information, 2013, p.20).

These Strands are broken down further into Elements and each of these elements lists a number of competencies or skills which are required to be attained by every pupil within that year group. So for example, a year 1 child might be expected to 'use the concept of time in terms of their daily and weekly activities and the seasons of the year' (LNF: Numeracy Framework, 2016). The principles of time will need to be taught and learned, but what time actually means, how it fits into our daily and weekly life is a concept that can be practised on a daily basis by visually relating a time on a clock to what we may be doing during our day. The use of a class timetable is useful here. In setting A we use a morning timetable which we go over as soon as registration is complete. We relate the time to what we will be doing that day, so for example, 9 o'clock is assembly, half past 9 is reading time, 10 o'clock is welsh followed by playtime. After playtime we have 1 hour of maths and then at 12 o'clock we go for lunch. A similar timetable follows for the afternoon

session, again discussed directly after afternoon registration. This makes time something that has relevance and meaning, which Piaget's Constructivist Theory (1977) tells us is an important process for learning, as a child will actively create or construct knowledge based on contextual experiences.

Additionally, a more formal focus task would also be completed with the purpose of imparting knowledge of time, and assessing each child's understanding and application of the task i.e. formative assessment. An example of such an activity could be using individual paddle board clock faces for children to write times on as requested by the teacher, with a focus on ensuring that the big and small hands are clearly marked. Furthermore, the seasons of the year could be learned by drawing pictures for the 4 seasons, concentrating on the key weather aspects, what we would be wearing in a particular season, what kinds of activities we would be doing (e.g. sledging/ swimming in the sea), and relating the time of year to our birthdays. Vygotsky (1978) suggested that 'development mainly happens as a result of interacting with other people,' so discussing ideas socially with others during group work, and providing opportunities for dialogue are important for the acquisition of knowledge and subsequent learning.

The Welsh Government (LNF: Information, 2013, p.3) stated that 'the LNF has been developed as a curriculum planning tool for schools that will provide a continuum of development, clearly setting out annual expected outcomes in literacy and numeracy'. The key aims of the LNF are to:

- help teachers of all subjects to identify and provide opportunities for learners to apply literacy and numeracy across the curriculum
- describe, with precision, the annual national expectations for literacy and numeracy for learners 5–14, and progression indicators for learners with additional learning needs
- help determine learner progress in literacy and numeracy and provide annual reports to parents/carers based on teacher assessment so that teachers, learners and parents/carers are all clear how learners are progressing and what are the next steps.

(LNF: Information, 2013)

Competencies can be built in to weekly and half-termly planning sessions to ensure that everything that needs to be covered is accounted for. Consequently a teacher will know exactly what level a year group should be working at, and can plan activities to provide for this. This works especially well in Setting A where staff across a year group are given time to plan together, and also share good practice across a phase/whole-school and with other schools, so that continuity exists. Planning is carried out in the short, mid and long term to enable a clear pathway of progression.

Because the same elements are covered all the way from early years through to year 9, developing in complexity and knowledge year on year, the framework can be used as an assessment tool. Bruner (2004) used the term 'Spiral Curriculum' where topics are revisited throughout various school years so that knowledge builds up in complexity and detail. Teachers can therefore use the framework to gauge the level a child is working at. This is done both formatively, as simple assessments of academic progress recorded by observational working with the children in small groups or individually, and summatively by statutory testing at the end of each year. The goal of summative assessment is to evaluate student learning at the end of a unit or topic by comparing it with some standard or benchmark, in this case the LNF. In fact the statutory formal tests that are done annually in May are written specifically to test the exact same competencies outlined in the LNF. For some competencies a learner may be working below their age group, and for others they may be as expected, or working above expected levels. As a consequence, we can readily see where catch up needs to be done with specific pupils, or where someone is working above a level and enhanced learning opportunities should be provided. Of course, things such as ALN, English as an Additional Language (EAL), and adverse home circumstances can play a part, but constant monitoring, and assessing both summatively and formatively ensures that a more reliable overall picture emerges, and can be planned to ensure that we support each child as 'whatever their level of attainment, pupils should not be allowed to experience repeated failure' (Cockcroft, 1982, p.68).

By using this information planning can be more effective, subsequently ensuring that a child is working in his/her Zone of Proximal Development (ZPD) (Bruner, 2004). The ZPD is the difference between what is already known by an individual, and the next step up in

knowledge terms where further learning occurs. In Setting A this can be seen in the classroom where a range of questioning styles are used with a learner to prompt thought and encourage recognition of links with previous knowledge.

But are we given enough time within the curriculum to address these issues? Because of the broad range of abilities that are present in a modern inclusive class inevitably the time spent on each topic is not enough for some, and it will be a struggle for these children to progress further if the foundation knowledge is not there. Conversely for some More Able and Talented (MAT) students the pace will mean that they aren't being pushed enough to stretch into the Zone of Proximal Development (Bruner, 2004). To overcome this 'differentiation occurs to support, consolidate and extend all areas of teaching for learning in order to allow all children to reach their potential' (Setting A, Curriculum Policy, p.7). Additional support is also provided where it is needed most, and all children can attain their own individual best.

Piaget (1977) suggested that by interacting with our environment we acquire building blocks of knowledge termed schemas which allow us to understand the world in which we live by making sense of every-day things that we have encountered previously. When we are faced with something new, we assimilate this knowledge and may alter or create new schemas. This process is known as accommodation. By using a cross curricular approach, this accommodation can occur in the classroom setting and means that the same thing need not be taught in multiple different subjects, but that knowledge and its applications can be transferred from one subject to another e.g. study skills may be taught in PSE, but will also be relevant in many other subjects to enhance the efficiency of someones efforts. After being taught how to construct a graph in maths, students can then use this in other subject areas, such as geography. Problem solving, decision making, reasoning, and interpreting data are all transferable skills which can be used in may areas of learning to great effect. In Setting A, 'the curriculum is organised into themes whereby year groups plan learning opportunities on a thematic basis. Wherever possible we try to establish links between areas of the curriculum' (Setting A, Curriculum Policy, p.6) and by forming these links a topic becomes relevant.

It has been suggested that 'significance has both a psychological and a socio-cultural basis, as both these aspects of students' lives are the basis from which students build meaning' (NSWDET, 2003). Knowledge without application or relevance is something that may soon be forgotten, but if numeracy is used and made relevant across the curriculum, then it becomes embedded, and will be something that becomes an enjoyable and valued skill. Furthermore, this cross curricular approach also ensures that time, which is at a premium in the classroom, is used economically. Therefore, in both primary and secondary schools, planning for developing numeracy skills needs to be truly cross-curricular rather than focused on mathematics lessons. For example, Setting A uses this cross-curricular approach to good effect where STEM (Science, Technology, Engineering, and Maths) group challenges have been created to aid learning. These rely on a person's prior knowledge to stretch them further to find a solution to a problem. For example the challenge to make the longest paper link-chain possible using an A3 sheet of paper. Challenges are most productive when used as a collaborative group activity, where dialogue occurs, and students can also learn from their peers prior knowledge. Children are required to engage in team work, think logically about the challenge set, make inferences, plan what they will do, carry out the challenge and record their results using suitable units of measurement. They are then able to use reflection once the task is completed to think about what went well/not so well, and where they could make improvements next time. Class results could also be presented in a graph or table. This uses many numeracy skills in one activity, but may not spark the interest of all pupils. It is important therefore to vary the challenges to ensure that all needs and abilities are catered for when planning.

There are numerous initiatives to enhance numeracy skills which are used widely such as:

Discovery or Active Learning where teaching staff provide the environment for the child to arrive at their own answers by making connections for themselves with knowledge they already have i.e. activating prior knowledge, and building upon this.

Digital tools such as Hwb and Active Learn Accounts are used in Setting A to enhance numeracy and digital competence simultaneously through a variety of applications, games and challenges, for example times tables races. Each pupil from Year 1 onwards

has their own account, which can also be accessed from home so that parents can be part of their child's learning. Additionally, initiatives such as coding clubs and business clubs teach the actual life skills of numeracy needed for business, and digital competency and are utilised by many children as extra-curricular activities.

The **Pupil Deprivation Grant (PDG)** is given to those schools in Wales receiving the highest proportion of Free School Meals, which are usually in the most deprived areas. 'Learners who are eligible for free school meals are already on average a year behind when they start school' (National Literacy and Numeracy Programme: A strategic Action Plan, 2016, p.18). The money can be used for extra resources and to fund staffing for catch up groups. According to the LNF strategic action plan (2013, p.1) 'the rate of improvement has more than doubled since the introduction of the Pupil Deprivation Grant'.

More in-service training to enhance the mathematical capabilities of primary teachers and support staff who are not necessarily specialists in maths, and also to increase the number of high quality maths teachers in secondary schools. 'Senior leaders report that improving the numerical skills of staff remains a priority to enable numeracy provision to be effective across the school' (Estyn: Numeracy in Key Stages 2 and 3, 2014, p.4). This would also entail revised professional standards so that continuous professional development of staff is a priority.

Parents play a considerable role in influencing a child's attitude to maths and so the Cockcroft (1982, p.62) suggests that they can be 'encouraged to make use of mathematics during normal family activities' such as paying for things when shopping, playing games involving turn-taking, score keeping and using weighing when cooking. These every day applications will develop familiarity with numbers and confidence in making use of them.

Looking forward, change is needed to ensure we 'create a more stimulating and challenging educational experience that will help [children and young people] to thrive and succeed in an increasingly demanding but exciting world' (Donaldson, 2015, p.112). The proposed new Curriculum for Life (now expected approx 2020) will consist of the 3

cross-curriculum responsibilities of literacy, numeracy and digital competence (LNF: Strategic Action Plan 2016), along with the wider skills which will be embedded within all Areas of Learning Expertise (AoLE). Testing will be done online using adaptive personalised tests which 'will adapt the difficulty of the questions to match the responses of the learner so that all learners will be presented with questions that match and challenge their individual skills in reading and numeracy.' (Williams, 2017).

In summary, numeracy within education has undoubtedly progressed and there are many strategies in use today to great effect. With promising steps forward being introduced it is important to note that these will not be possible without investment of time, money and sustained commitment at all levels. There will always be more that can be done to ensure all pupils academic outcomes are improved, and as educators we must also ensure that the range of activities on offer is varied and differentiated to deliver a stimulating and inclusive education. 'Maths requires hard work and much practice' Cockcroft (1982) but when the principles have been learned, the applications to which these skills can be put are numerous.